Lesson 15: Earned Value Management

The Challenge of Earned Value

The most difficult part of program management is knowing:

- If the program is on schedule,
- If the program is costing more than planned, and
- What can be done if the program deviates from the plan.

Earned Value Management provides the processes and information necessary to manage the program effectively. Without Earned Value Management, there is little more than guesswork. The following is an example of what could happen if you don't use Earned Value principles to manage the cost, schedule, and performance of your program:

The contractor on a recent program had planned to spend $10 million during the first 6 months of the contract.

- The contractor met that target, and legitimately billed the Government for $10 million.
- Unknowledgeable observers were pleased to see that the contractor was on track.
- However, the Earned Value analysis showed that the contractor had spent that amount on half the work that had been planned.
- Instead of being on track, the work was significantly behind.

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Earned Value: An Analogy

The following familiar example of taking a cross-country trip is used to help illustrate the problem. Managing a program is similar in many ways to taking a trip across the country.

In Managing a Trip...

- There is a fixed destination.
- Resources (time and money) are finite.
- Driving speed and daily mileage can be monitored and corrected.

In Managing a Project...

- There is a project to complete.
- Resources (time and money) are finite.
- The work pace and daily progress can be monitored and controlled.

The Task or Work

Imagine that you must drive across the country. You:

- Must travel from San Diego, CA to New York, NY - about 3,000 miles.
- Plan to take 10 days to complete the trip.

- Budget about $2,000 to pay for gas, food, and lodging.

The Apparent Status

For a 3,000-mile trip costing $2,000, over 10 days:

- You need to drive about 300 miles per day.
- You plan on spending about $200 per day.

This isn't a frantic pace. The trip seems reasonable, and could even be fun. In fact, after traveling for 3 days, you have traveled 1,000 miles and spent $500.

- You are ahead of your 900-mile goal.
- You spent less than your planned $600.
- You expect good roads and weather ahead.

This trip seems to be going well. **Or is it?**

The Real Status

Looking at the trip a little closer, you have traveled 1,000 miles and spent $500, but:

- You spent $150 and a full day to replace the fan belt in Needles, CA.
- You backtracked to pick up the forgotten family dog, which caused you to start the trip all over.
- Your "spontaneous" detour to the Grand Canyon caused a "minor" delay, adding more miles and dollars.

Three days and $500 into the trip and the destination is not much nearer than when you began. The problem with the initial observation is that the miles traveled and dollars spent had little relation to the actual progress toward your destination.

There has to be a better way.

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Creating a Realistic Measure of Progress

Progress on the trip must be tied to achieving objective milestones.

- In planning the trip, specific cities are identified as daily milestones.
- The budget is distributed across the trip, assigning a specific amount to each city.
- The "value" of reaching each city is defined as the amount budgeted to get there.

Goal	Time	Miles	Budget
Phoenix	Day 1	300	$200
Grand Canyon	Day 2	600	$400
Albuquerque	Day 3	900	$600
Amarillo	Day 4	1,200	$800
And so on, until...			
New York City	Day 10	3,000	$2,000

Creating an Objective Measure of Progress

Objective measures for assessing progress toward a goal are based on the project plan that integrates the work scope, schedule, and budget:

Elements	Examples
Work Scope	Reach Amarillo
Schedule	Day 4
Budget	$800

Objective measures of performance provide information useful to the management decision process.

Decisions Based on Objective Measures

Knowing the true status can help make decisions that will achieve the objective. At the end of day 3, you only made it to Phoenix. Compared to the plan:

- The trip is 2 days behind schedule and $300 over budget so far.
- Maintaining this pace, the trip could take up to 30 days and $5,000 to complete!
- Even if you resumed the originally planned pace and budget from this point on, you will arrive in New York 2 days late and $300 over budget.
- To arrive on time you must average 386 miles each day.

With this information, you can manage the cost and schedule impacts to the trip.

	Plan			Actual		
Goal	**Time**	**Miles**	**Budget**	**Time**	**Miles**	**Cost**
Phoenix	Day 1	300	$200	Day 3	500	$500
Grand Canyon	Day 2	600	$400			
Albuquerque	Day 3	900	$600			
Amarillo	Day 4	1,200	$800			

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What Is Earned Value Management?

Earned Value Management is a management tool that:

- Relates the scope of the work to its associated budgets and schedule.
- Measures the work progress in objective terms.
- States the value of the work completed in dollars, or other measurable units.

When the plan integrates work scope, schedule, and budget, and project status is determined using objective measures, then the true status of the effort is known.

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Earned Value Management Overview

An Earned Value Management System is a series of processes that relate scope of the work with schedules and budgets. An Earned Value Management System will:

- Establish a comprehensive work plan known as the Performance Measurement Baseline.
- Measure performance against this baseline using objective measures.

Scope, Schedule, and Budget

An effective Earned Value Management System must develop a plan that integrates the work scope with the schedule and budget. The system must use objective measures to determine the value of the work completed compared to the plan.

<table>
<tr><th></th><th>Scope</th><th>Schedule</th><th>Budget</th></tr>
<tr><td>Work Planned</td><td>What work is scheduled?</td><td>When is it scheduled?</td><td>How much is budgeted?</td></tr>
<tr><td rowspan="2">Work Completed</td><td>What work was done?</td><td>When was it done?</td><td>How much was budgeted for it?</td></tr>
<tr><td colspan="3">How much was actually spent?</td></tr>
</table>

Linking **scope, schedule, and budget** is critical to the success of any Earned Value Management System.

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Data Elements

A management system consistent with Earned Value Management principles provides three data elements useful in assessing the status of a project:

- The budgeted value of the work planned.
- The budgeted value of the work completed, or Earned Value.
- The Actual Costs incurred.

The Plan is the cumulative amount budgeted for the work by a given date.

Earned Value is the sum of the amount budgeted for the tasks completed so far.

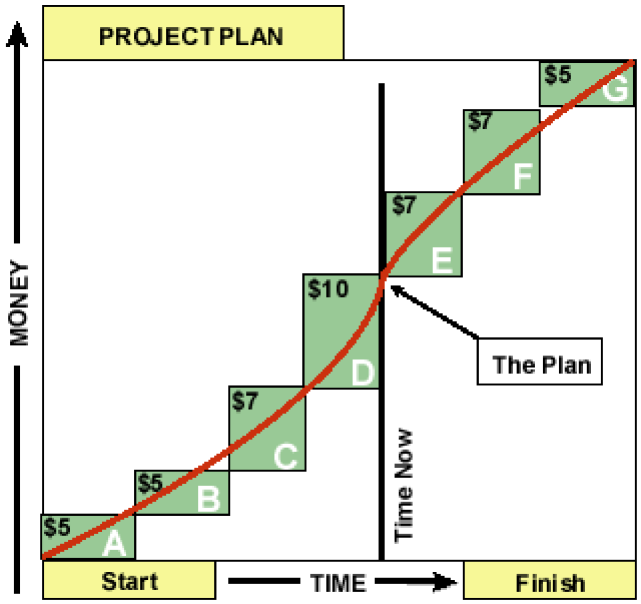
Actual Costs are the costs experienced in accomplishing the tasks completed so far.

The Plan

The Plan is known as the Performance Measurement Baseline (PMB) Shown below are seven tasks of a sample plan (labeled A, B, C, etc.). Each task has resources and schedule allocated to it. The solid line shows the PMB.

The PMB:

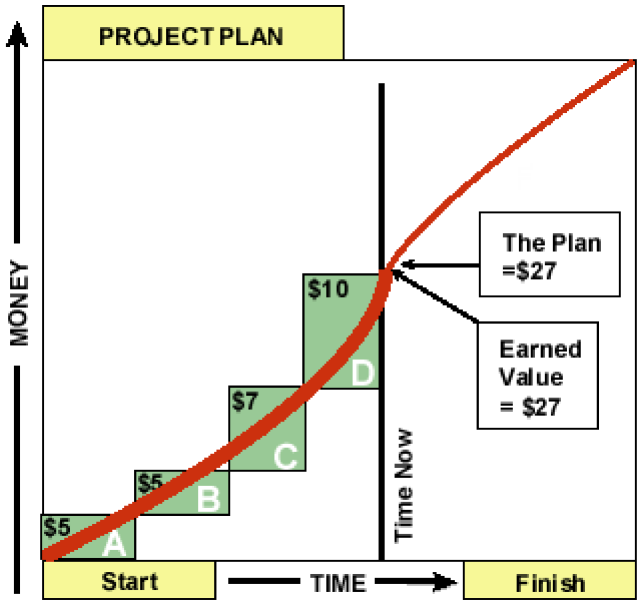
- Represents the budget and schedule associated with each task.
- Depicts:
  - The work to be done,
  - When the work is expected to be accomplished, and
  - The "budgeted value" of that work.



Earned Value - Case 1

The value of the work performed is stated in terms of its budget. This is known as the project's Earned Value.

- If the work is going according to plan, tasks A, B, C, and D are complete.
- The project's Earned Value is the sum of the budgets of completed tasks—$27 in the example shown below.

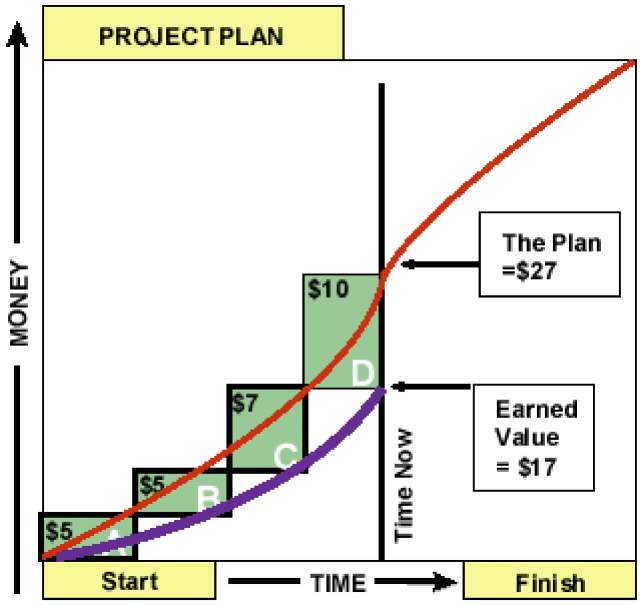


Earned Value - Case 2

However, if only tasks A, B, and C are complete:

- The work is behind schedule, because task D was also supposed to be done.

- The project's Earned Value is the sum of the budgets of completed tasks A, B, and C, or $17.

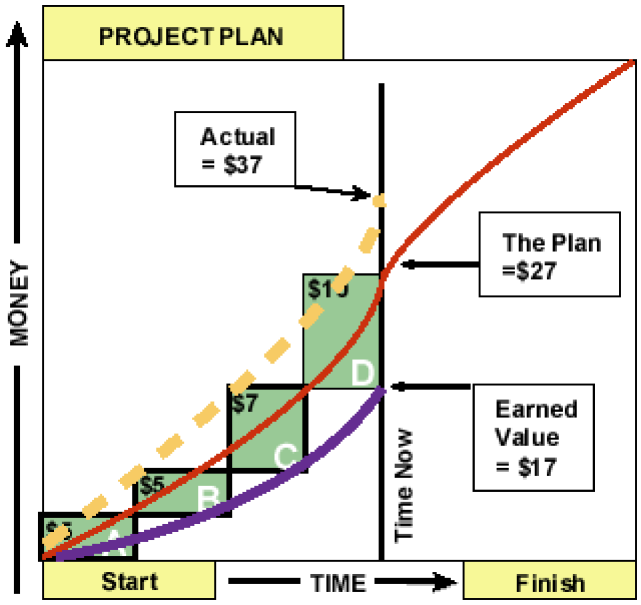


Actual Costs

As work is accomplished, and costs are accumulated, those costs can be tracked and compared to the value of work.

Depending on the efficiency and pace of the work, actual costs may turn out to be:

- The same as the Earned Value,
- Or lower,
- Or higher.



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Comparing Data Elements

By comparing these three data elements—: the Plan, the Earned Value, and Actual Costs—the cost and schedule status of the program can be determined.

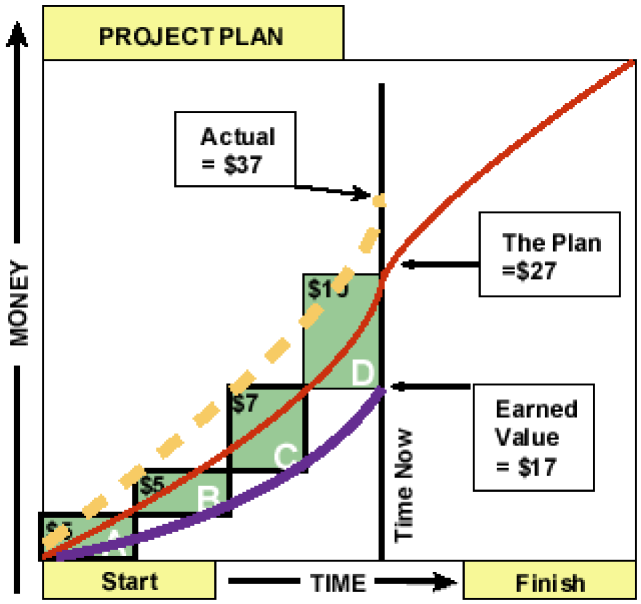
Earned Value Output: Schedule Status

To determine the **schedule status**, compare the **Earned Value,** or value of the work performed, to the **planned value**, to derive the schedule status in dollar terms.

Example:
Earned Value = $17
The Plan = $27

The project was planned to complete $27 worth of work, when in fact, only $17 worth of work was completed.

The project is $10 **Behind Schedule**.



Earned Value Output: Cost Status

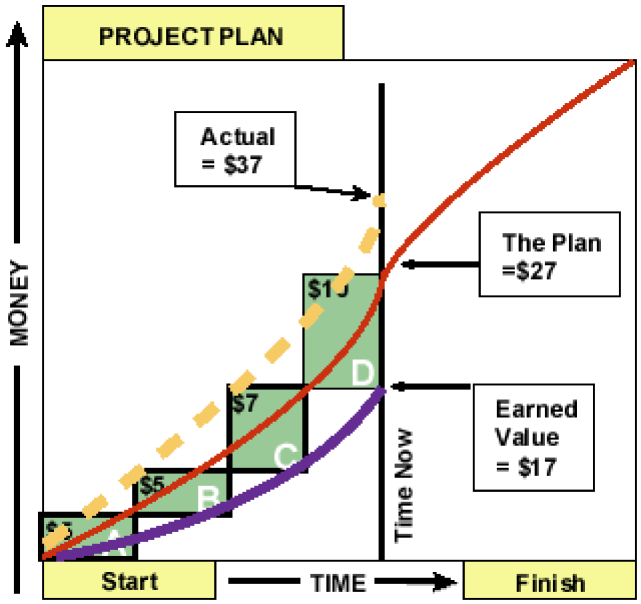
To determine **cost status**, compare the **Earned Value,** or value of the work performed, to the **actual cost** incurred to find the project's cost status.

Example:

Earned Value = $17
Actual Cost = $37

The project has incurred a cost of $37 to achieve only $17 worth of work.

The project is $20 **Over Budget**.



Cost and Schedule Status Examples

The table below shows several examples of different situations where the data elements provided by an Earned Value system can reveal the Schedule and Cost Status of a program.

Plan	Earned Value (EV)	Actual Costs	Schedule Status * (Plan vs EV)	Cost Status (Actual vs EV)
$100	$80	$100	Behind Schedule $20	Over Budget $20
$100	$100	$100	On Schedule	On Budget
$80	$100	$80	Ahead of Schedule $20	Under Budget $20
$100	$120	$140	Ahead of Schedule $20	Over Budget $20
$100	$80	$60	Behind Schedule $20	Under Budget $20

* Note that the Schedule status is measured using dollars, not time.

This indicates that the program is ahead (or behind) by an amount of work whose budgeted value is as shown.

Integration Is the Key

Earned Value Management Systems must have the ability to integrate the work with the associated budgets and schedule. When an integrated plan is developed, program managers are able to:

- Compare the value of the work performed to the actual costs incurred and to the value of the work planned.
- Use this information to identify and take appropriate actions in a timely manner to mitigate

costs and schedule impacts.

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Earned Value Management Systems

Earned Value Management Systems use the information derived from the three data elements to manage the day-to-day program operation. An Earned Value Management System must be able to perform several important functions:

- Develop an integrated plan, and
- Measure performance using objective metrics or criteria.

Earned Value Management Systems Criteria

The Earned Value Management Systems Criteria have two primary objectives:

- For contractors to have and use integrated internal management processes of their own choosing.
- For these systems to provide timely and meaningful data for use by both contractor management and Government management.

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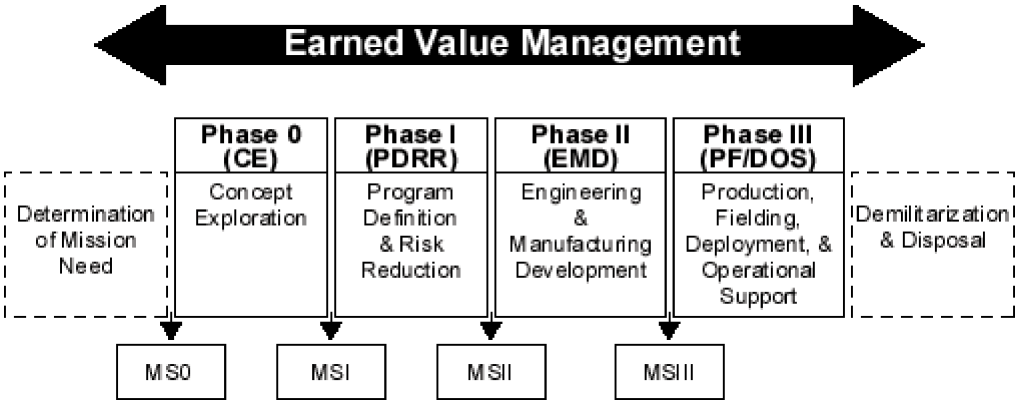
Earned Value Management in Defense Acquisition

Earned Value Management techniques apply throughout the acquisition life cycle when the Government shares the risk with the contractor. The visibility and management control required by Earned Value Management principles can help manage project risks.



Higher Risk Programs

The DOD requires contractors to use management systems certified by the Government as consistent with Earned Value Management Systems Criteria (DOD 5000.2-R, Appendix VI).

DOD 5000.2-R mandates the more detailed "Earned Value Management Systems Criteria (EVMSC)" application on higher risk, Non-Firm Fixed Price contracts at the following thresholds:

- $70 million or more RDT&E (in constant FY 96 dollars)
- $300 million or more Production (in constant FY 96 dollars)

These thresholds serve as a "trip-wire" at which the EVMSC are mandatory, and contractor systems will be Government-Certified.

On Non-Firm Fixed Price contracts (Non-FFP) that are less than the dollar threshold values, Program Managers have discretion (as the risk warrants) to require the contractors to apply the full EVMS Criteria. The contractor's system must be Government-certified and use objective performance measures. When the Government requires the contractor's system to meet the full EVMSC, the PM will request the more extensive Cost Performance Report (CPR). The Government will:

- Tailor information requirements to meet management needs, and
- Use contractor formats.

Lower Risk Programs:

The Government requires contractors to apply Earned Value Management Principles to their management processes, yet does not require the system to be certified by the Government.

Program Managers require contractors to use Earned Value Management Principles on all Non-Firm Fixed Price contracts, since the Government shares the risk. When the PM determines risk is not sufficient to warrant the full EVMSC application, the Cost/Schedule Status Report (C/SSR) applies. C/SSR applications are mandatory for contracts:

- Valued at $6 million or more.
- At least 12 months duration.

When the Government requires C/SSR level of earned value, the PM may obtain either the **CPR-No Criteria**, having more data elements, of the less extensive **C/SSR**. For either report selection, the PM will:

- Tailor information requirements to meet management's needs, and
- Use contractor formats.

Cost Performance Report (CPR) – No Criteria

The CPR option gives program managers a selection of up to five formats, each including an array of data elements. The "No-Criteria" refers to the fact that the contractor's management system that produces the reports, is not required to be certified as consistent with the Criteria.

Cost/Schedule Status Report (C/SSR)

The C/SSR option gives program managers a selection of two formats:

- Earned Value information by Work Breakdown Structure (WBS).
- Contractor's explanations and analysis.

Applicability of Earned Value Management

Earned Value Management principles:

- Apply to Government contracts with industry.
- Apply to internal Government projects and activities consistent with the thresholds identified for industry contracts.
- Have been used effectively on commercial business projects, both nationally and

internationally.

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Earned Value Management Systems Criteria Validation

Depending on the risk level, the Government validates or certifies that the contractor's system is consistent with the Earned Value Management System Criteria. The Government does not mandate the use of a specific management system. Contractors will use their own distinct management system. However, the contractor's system must:

- Produce valid, timely, and accurate data.
- Provide the same data to the Government as that used by the contractor.

Earned Value Management Systems Criteria: Details

Earned Value Management System Criteria are used by the Government:

- As guidelines to evaluate the contractor's specific management system.
- To help assess the contractor's system as an integrated whole, not just independent elements.

The Criteria are structured in five areas common to a contractor's management processes:

Organization

Does the contractor's system:

- Define the authorized work?
- Assign responsibilities?
- Define procedures to allocate indirect costs?
- Establish management controls?

Planning, Scheduling, and Budgeting

Does the contractor's system:

- Authorize all the work?
- Schedule all the authorized work?
- Develop key management control points (i.e., the lowest level to be monitored)?

Revisions

Does the contractor's system:

- Maintain baseline integrity?
- Allow no retroactive changes?

Accounting

Does the contractor's system account for:

- Material costs?
- Unit and lot costs?
- Cost summarization?

Analysis

Does the contractor's system provide data that are useful in:

- Depicting contract status?
- Developing estimates?
- Making decisions?

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Earned Value Management Surveillance

Three key players perform joint surveillance:

- The **Contractor** is fully responsible for establishing and maintaining their internal management processes.
- The **Program Management Office** is part of the team that monitors the contractor's ongoing management processes.
- The **Contract Administration Office**, primarily the Defense Contract Management Command (DCMC), performs ongoing surveillance, with an emphasis on insight into the contractor's internal management process and disciplined controls.

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Who Are the Key Players?

As previously stated, there are three primary players related to Earned Value Management:

The Program Management Office (PMO)

The role of the PMO is to:

- Send a clear message to the contractor that Earned Value Management principles are important to a well-managed program.
- Ensure that PMO staff members are properly trained to perform their Earned Value Management roles.
- Lead the technical staff or Integrated Product Team (IPT) to review the contractor's work plans within 6 months after award.

Defense Contract Management Command (DCMC)

DCMC has the primary role of surveillance. However, joint surveillance is conducted by a team consisting of DCMC, Program Office, and contractor personnel.

- Surveillance is the basis for having confidence in the contractor's discipline, and adherence to their own internal procedures.
- Surveillance allows the Government to monitor contractor system operation.
- Surveillance ensures the contractor's system continues to meet contract EVM requirements and provides valid, accurate, and timely management information.

Contractor Management

The contractor role as a key player is obvious in that they perform the work required by the contract. The contractor will identify key management control points, called Control Accounts, appropriate to

their organization and type of work. The managers of these key accounts are called Control Account Managers (CAMs).

CAMs are senior technical personnel who have several important functions:

- Develop near-term work packages and far-term plans.
- Assign and schedule the work.
- Maintain the project status by tracking work planned, work performed, and actual costs.
- Analyze status and revise plans as necessary.
- Develop estimates of the cost at completion.

The CAM functions are the core of a contractor's Earned Value Management System.

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Integrated Baseline Review (IBR)

DOD 5000.2-R requires program managers and their technical staffs or IPTs to review contractor-planning baselines within 6 months after contract award. The program manager's review of a contractor's performance measurement baseline (PMB) is known as an Integrated Baseline Review (IBR).

The IBR's goals are to:

- Ensure reliable PMBs are established that integrate technical work, schedules, and resources.
- Improve the use of contractor performance data by managers.
- Reduce the number of EVMS Criteria management system reviews

An IBR may produce disagreements, but the contractor cannot fail an IBR. When system concerns surface, the PM will refer them to the cognizant surveillance organization.

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Earned Value Management Implementation

Earned Value Management has proven itself to be a valuable management tool which gives program managers the ability to accurately assess program status.

When successfully implemented, Earned Value Management ensures:

- Disciplined planning processes,
- Baseline work plans that integrate work scope, schedule, and budgets, and
- Objective measures of the work completed.

Earned Value Management Benefits

Earned Value Management principles provide:

- Meaningful control over the work.
- A valid way of relating costs to work accomplished.
- A reliable way of estimating the cost to complete a project.

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